A recipe for baked Ammonites

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A recipe for baked Ammonites by Dr Peter Wilson

The ingredients required for this recipe generated considerable debate around two hundred years ago. At that time geology was a very youthful science but had many enthusiastic advocates. Inevitably enthusiasm sometimes got in the way of the science and errors were made. But that is how science advances: theories and hypotheses are proposed only to be found wanting as new ideas are outlined, tested and (sometimes) accepted. Scientists learn from their mistakes, or should do. And so it was in Portrush in the late 18th and early 19th centuries, resulting in a major geological paradigm shift.

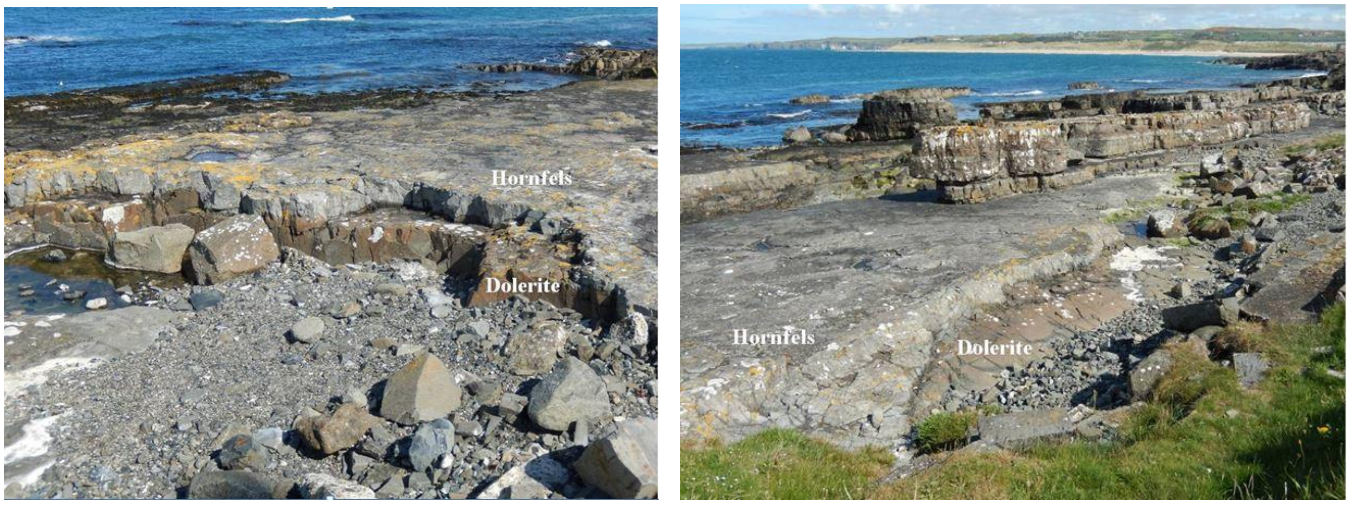
The rocks that caused all the fuss and put Portrush at centre stage of geological debate for a number of years are those on the foreshore alongside Bath Road / Lower Lansdowne Crescent, in the vicinity of the Coastal Zone centre and Port-an-dhu Harbour. Today it is perhaps difficult for us to envisage just how those unassuming rocks became, in the words of Irish naturalist Robert Lloyd Praeger, “a monument to a famous battle”.

It could be said that the story started in 1775 at the University of Freiburg, Germany, with the appointment of Abraham Gottlob Werner as Professor of Geology. He has been described as a brilliant but rather dogmatic teacher and was regarded as the foremost geologist in Europe. His views permeated the subject to such an extent that for a period they dominated geological thought across the continent. The Werner school of geology held that all rocks, with the exception of modern day volcanic lava, could be explained by formation in sea water. Even crystalline rocks were thought of as chemical precipitates from water.

View across the Bath Road / Lower Lansdowne foreshore – “a monument to a famous battle”.

Because of this view Werner and his acolytes became known as ‘Neptunists’. However, they did not have it all their own way and were opposed by other geologists known as ‘Vulcanists’ (or ‘Plutonists’). These scholars believed that crystalline rocks had once been molten and had crystallised as the magma cooled. Vigorous debate ensued and because Neptunism was associated with the Biblical flood, as described in the Old Testament, opponents were regarded as heretics.

The rocks at Portrush were key to this controversy. The bulk of the rock that is visible on the Bath Road / Lower Lansdowne foreshore dates from the early part of the Jurassic period (about 200 million years ago). Essentially the rock is part of the Waterloo Mudstone Formation that can be seen at several other places along the Antrim coast. The mudstone represents shallow-water marine sediment and contains numerous fossils, with ammonites being particularly abundant. However, at Portrush the mudstone has been transformed by high temperatures (thermal metamorphism) into a hard and brittle rock that geologists call hornfels. This baking process did not destroy the fossil ammonites.



Two views showing the contact between the brown dolerite of the Portrush Sill and the overlying grey hornfels.

Some of the fossil ammonites in the hornfels.

At the end of the 18th century the hornfels with its fossil ammonites was identified (mistakenly as it turned out) as basalt by geologist and Neptunist Richard Kirwan. This classification was supported by the Rev. Dr. William Richardson, of Ramore House. He considered it as incontrovertible proof that basalt formed by crystallisation from sea water – the ammonites being sea creatures - and that Prof. Werner's and the Neptunists' view of rock creation should prevail. Richardson published his opinion on this topic in *Transactions of the Royal Irish Academy* for 1803.

When this came to the attention of the wider geological community it generated almost as much heat as had been necessary to bake the mudstone! A flurry of activity followed as both local geologists and others from across the water visited Portrush to see the 'evidence' for themselves.

It took some time and much argument from several eminent geologists, including Professor John Playfair of Edinburgh University, but it was eventually accepted that the Portrush Rock (as it had become known) was not basalt. It was in fact a sedimentary rock – mudstone – that had been cooked or baked by an intrusion of dolerite, such that some of its original properties had been altered. Technically, it is now a metamorphic rock.

Fragments of the Portrush Sill dolerite (an intrusive igneous rock) and the hornfels (metamorphosed mudstone).

The intrusion responsible for the baking process is known as the Portrush Sill. In its molten state, some 55 million years ago, it would have been at a temperature of around 1200 ºC. Unlike the Antrim basalts, this magma did not erupt onto the surface. Rather, it welled up gradually from below, forced its way along the bedding planes in the mudstone and cooked it at temperatures exceeding 650 ºC. Then it slowly cooled and created a sheet-like body of dolerite.

The sill forms the promontories of Ramore Head and Reviggerly Point, and underlies much of the town. It also forms the offshore islands of the Skerries. The sill is known to be at least 45 m thick and it baked an 8 m thickness of overlying mudstone to hornfels. The contact between the dolerite and the hornfels can be seen on the foreshore, the dolerite being brown in contrast to the grey of the hornfels. The rather patchy present-day distribution of the hornfels across the promontory, as depicted on geological maps, is testimony to vigorous erosion by water and ice in the intervening years.

Today, all is quiet along the foreshore, the controversy is over. But the site is an extremely important one and is visited frequently by both professional and student geologists. Some years ago the locality was declared a National Nature Reserve and an information board erected near the Coastal Zone centre. It has also been designated as an Area of Special Scientific Interest and it is an offence to collect samples.

Ammonite gate beside the Arcadia.

You have been warned!

The ammonites are best left where they have been resting for the last 200 million years. Their significance is widely recognised and their coiled form has been included in various designs around the town.

Our thanks to Peter for this excellent contribution to our Heritage Newsletters. January 2nd 2021